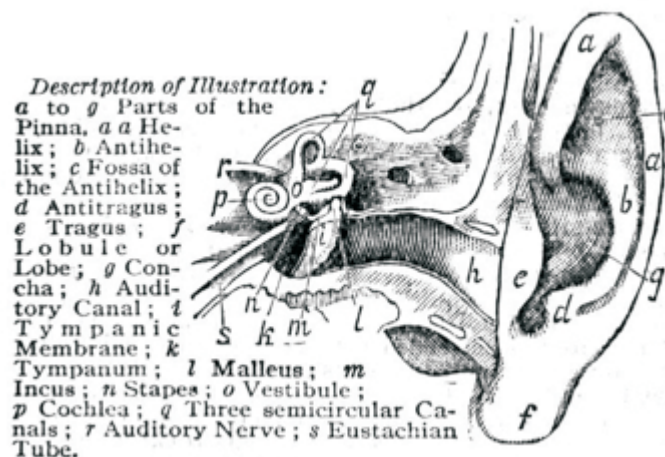


Hearing impairment

Hearing impairment affects many children and adults either temporarily (e.g. fluctuating hearing loss in children) or permanently. Hearing loss in childhood can severely delay speech and language development, and most adults will experience a deterioration in their hearing as they get older. Thankfully, hearing aid technology has moved a long way in recent years. Digital hearing aids are now much smaller, are able to pick up less background noise, and tune in more specifically to speech frequencies. Unfortunately, amplification of sound will never replace normal hearing. The development of cochlear implants however, have provided many profoundly deaf children and some adults with a hearing system that allows them to hear speech more clearly as well as develop their own speech skills. Neonatal screening programs are also leading to early detection of hearing loss and allowing parents and professionals to prepare earlier for the hearing impaired child and put appropriate systems in place to facilitate communication and learning.

How does hearing work?

Hearing is a very complex process. When the sound reaches the ear, a complex chain of events will occur before the sound is registered and understood by an individual. Any problems that occur during this process may cause hearing impairment or deafness.



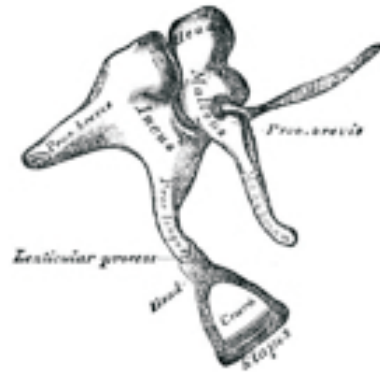
Outer Ear

Initially, the sound will travel through the air and reach the outer ear (the part you can see on the side of your head, also called the pinna). It will then travel down the auditory canal and causes the tympanic membrane (ear drum) to vibrate.



Middle Ear

The tympanic membrane vibrates and sends the vibrations along 3 tiny bones (the ossicles) in the middle ear, the malleus, incus and stapes (also called the hammer, anvil and stirrup) to the cochlea.



Inner Ear

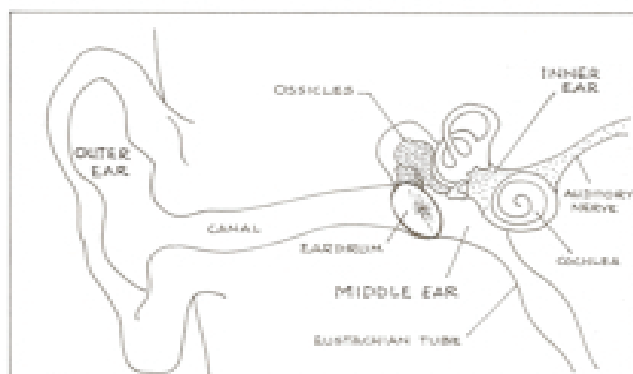
The vibrations then reach the cochlear and this sends tiny waves through the fluid in the cochlear and displaces a layer called the basilar membrane. The displaced basilar membrane excites minute hair cells. The hair cells send electrical signals along the auditory nerve fibres to the facial nerve

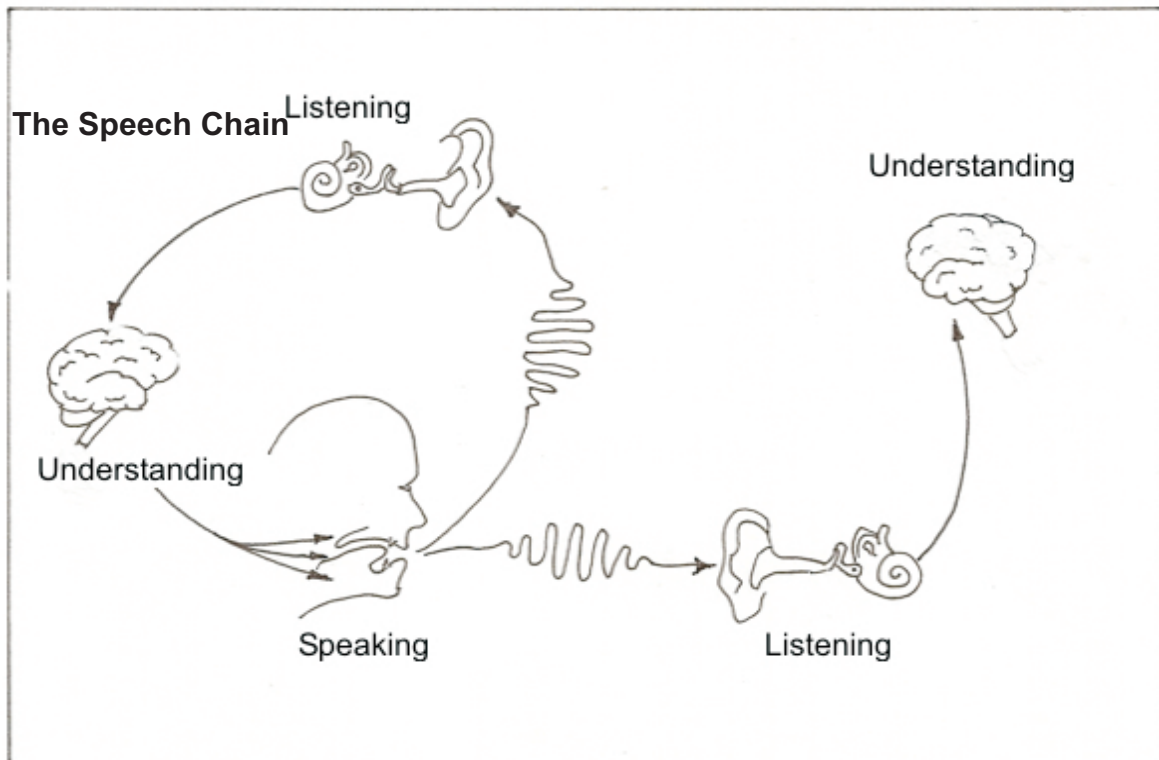


Central Auditory Nervous system

The nerve fibres send the auditory information through several processes in the brain to the auditory cortex where the information is processed and we usually understand or recognise it. This whole process takes less than a second.

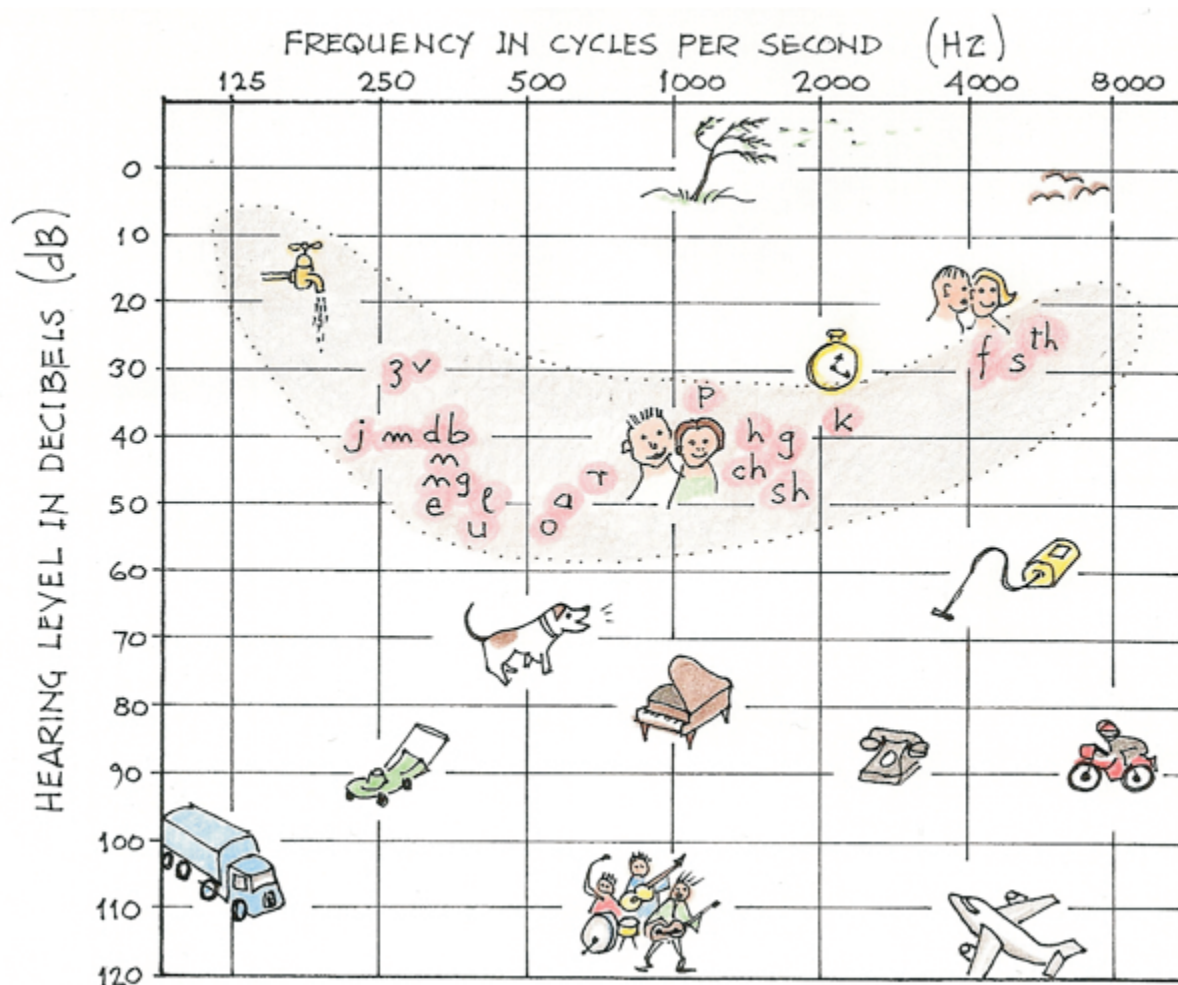
A problem at any point from the outer ear to auditory cortex can cause a hearing impairment, or a problem with understanding information when it is being processed (auditory processing disorder).





The Speech Chain

The Speech Chain shows how important hearing is in the whole communication process, not only for the listener, but also for the speaker. When we speak we are receiving feedback of what we are saying through our ears. We are able to monitor our volume, articulation and that what we are saying is making sense. At the same time, we are processing this information and our brains are planning what we will say next, and sending these signals to our speech apparatus. While this is happening, the listener is hearing our speech, processing it and (hopefully) understanding what we are saying. The inability for hearing impaired people to monitor their own speech is one reason why they may sometimes have difficulties producing clear speech.



The “Speech Banana”

The diagram above represents an audiogram and shows the noise level and frequency of many familiar sounds. As we can see from the diagram, rock bands and jet aeroplanes are very loud, producing sounds at around the 120 decibel level, while a dripping tap and whispering is around the 10-20 decibel level. The shaded area is sometimes called the “Speech Banana”. Normally spoken speech sounds fall within the banana shaped area. Normal speech is spoken at around 30-50 decibel level, with individual sounds varying in frequency. For instance, an “m” sound is much lower in frequency than an “s” sound. This is important to be aware of, because certain forms or degrees of hearing impairment can have a greater or lesser effect on the perception of certain sounds.



Hearing impairment

Hearing impairment can occur for several reasons:

- Some babies are born with hearing impairment, usually due to genetic reasons, or some form of trauma during the pregnancy or birth
- Damage to the hearing mechanisms due to loud noise exposure, disease, trauma, or exposure ototoxic drugs is likely to damage the hearing mechanism in the long term
- Some form of blockage in the outer or middle ear (see section on Otitis Media) will cause hearing impairment, although this may only be temporary

Once hearing impairment has occurred it may be more likely to effect high or low frequency sounds, or both, depending on the nature and extent of the impairment. Hearing impairment can effect the outer and middle ear (conductive loss) or the inner ear (sensori-neural loss).

Conductive hearing loss

Conductive hearing loss occurs when there is a problem occurring at the outer and/or middle ear, and hinders the sound from reaching the inner ear. Some conductive hearing loss is temporary and treatable. With the outer ear, anything that blocks the auditory canal (wax, foreign object, swelling from infection etc), can impede sound.

Conductive hearing loss is common amongst children with around 6% of children experiencing at least one episode, mainly due to otitis media ("glue ear") of the middle ear. For some children the problem persists or recurs and this may affect speech and language development.. Conductive loss can be caused by infections, a perforated eardrum, wax blockage, damage to the ear or osicles, and disease. Otosclerosis is another disorder that can cause a conductive hearing loss and is caused by abnormal bone growth within the middle ear (although it is a rare disorder).

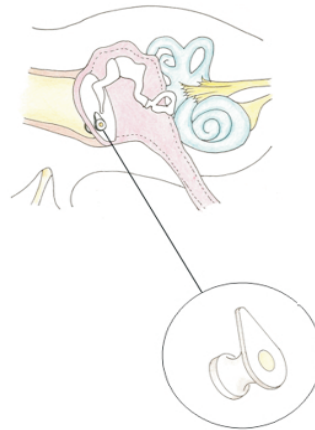
Otitis Media

Otitis media is the most common cause of conductive hearing loss in children and is a general term to describe a number of conditions affecting the middle ear. Infections can cause a lot of pain, the tympanic membrane (ear drum) to rupture, and fever. The inflammation of the middle ear caused by this infection can affect the conduction of sound. Otitis media with effusion is an infection of the middle ear which also causes a collection of fluid in the middle ear space. If this fluid remains for a period it can become thick and glue like (hence the term "glue ear"), hindering the middle ear to effectively carry sound. Otitis media can be a long term infection and can keep recurring over the early years of a child's life. It is important to be aware that your child's hearing could be impaired and you may not have any obvious signs. If you have concerns ask your doctor for a referral to an audiologist or Ear, Nose and Throat (ENT) Specialist, because prolonged hearing impairment in the early years can cause a delay in speech and language development.



Grommets

Antibiotics are generally used to clear an otitis media infection, or if the infection persists a tympanostomy tube (often called a “grommet”) may be inserted to drain the fluid and equalize the pressure in the middle ear. Grommet's can be highly effective and generally just fall out of the ear after several weeks or months. Parents have noticed huge changes in their child's communication and behaviour following the fitting of grommets.



How a grommet sits in the ear.

Sensori-neural hearing loss

Sensori-neural loss is a result of damage to the inner ear (cochlear) and/or the auditory pathways that carry sound to the brain. There are a number of factors that are responsible for sensorineural loss including injury, exposure to loud noise, disease, certain ototoxic drugs, meningitis, tumours, stroke and genetic causes. The most common cause of sensori-neural loss is be presbycusis which may be responsible for up to 90% of hearing impairment amongst adults. Presbycusis is an age related hearing loss and describes what happens to most people as they get older. As we age the nerve cells in our cochlear die and get damaged and we see decline in our hearing ability. With children, around 50% of cases of sensori-neural loss will have a genetic cause, and loss may also be caused by birth prematurity, or infection during pregnancy. Sensori-neural loss is most likely to affect our ability to hear higher frequency sounds. Inner ear hearing problems may also include recruitment, which makes the ear more sensitive to louder sounds, so although there is a hearing loss, a sound level slightly above the level of hearing can be painful.

Tinnitus

Tinnitus can also accompany hearing impairment in later life, with a constant or intermittent sound in one, or both ears. This sound can be very distracting and unpleasant, especially when trying to get to sleep. There are a number of different devices that can help with tinnitus such as devices that produce soothing background noise to help with sleep or when trying to concentrate in a very quiet environment. Some people have also found complementary therapies such as acupuncture may help. It is always best to discuss any treatments or therapies with your doctor before embarking on them.

Mixed hearing loss

A mixed hearing loss is less common, but it is possible for an individual to have both a conductive and sensorineural hearing loss, a mixed hearing loss.



Hearing loss indicators

If there is a family history of hearing impairment, a diagnosed syndrome associated with hearing impairment, or you have had certain infections during pregnancy it is important to have your child's hearing checked early. The same is true if the baby was premature or has suffered difficulties during birth. In the first 2 years of life it is important to be aware that a hearing difficulty can arise from meningitis, head trauma, certain ototoxic medications, and otitis media. Babies should display certain behaviours if they are hearing:

Young babies should:

- Respond to your voice
- React to sudden noises
- Like musical toys
- Turn towards you when you speak
- Use different sounds during babbling.

Older children and adults may display a number of other signs that they have a hearing impairment:

- They do not respond to loud sudden noises
- They do not respond when you talk or call them
- Speech and language is not developing along normal milestones
- They have difficulty following instructions, especially when they are not looking at you when you speak
- They need the TV turned up loud
- They may be withdrawn
- They may appear to mumble more frequently
- They might experience tinnitus or recruitment

To find out more about hearing, hearing impairment, hearing aids and ideas and activities to assist hearing and hearing skills, go to www.icommunicatetherapy.com

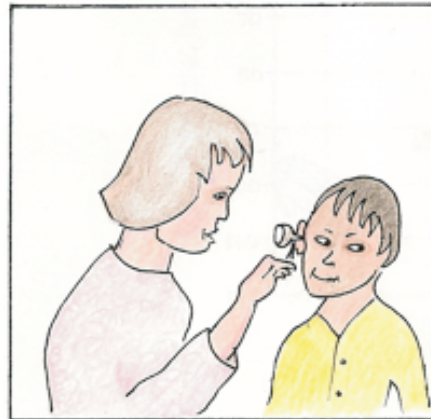


Hearing Assessment

A hearing assessment will determine an individual's level of hearing. There are a number of different tests that may be specifically for the middle ear, or the inner ear and auditory pathways. It may take a couple of different tests to exactly pinpoint the true cause of a hearing impairment.

Middle ear testing

Tympanometry or acoustic reflex measures are procedures to measure the functioning of the middle ear. Tympanometry measures the feedback from sounds put into the ear and reflex measurements focus on the movements of the muscles in the middle ear in response to sound.



Sensori-neural testing

There are several objective measurements for testing sensorineural impairments:

Auditory brainstem response (ABR) measures the response along the auditory pathway by taking measurements from electrodes on the head.

Auditory Steady State Response (ASSR) is relatively new test and is often done in conjunction with ABR test. This test also measures the brains response to sound.

Evoked Otoacoustic Emissions are a measurement of the low-intensity sound energy that is generated by the cochlear when it responds to sound. This is measured by sending sound into the ear and placing a microphone in the ear canal to measure the cochlear's response.

These tests are commonly performed on newborn babies or infants to assess for hearing loss. Along with these tests, children may participate in a behavioural, or play audiometry assessment where the audiologist produces sounds and observes the babies behaviour or response to sounds.

For more details on hearing assessment and hearing aids see www.icommunicatetherapy.com)



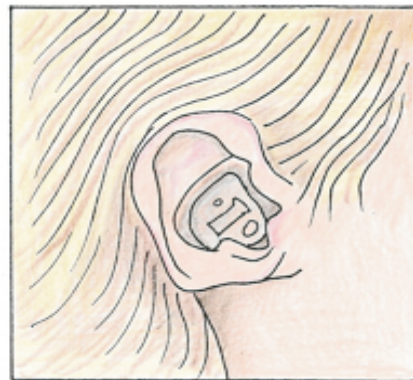
Hearing aids

Following a hearing assessment, if an impairment is present the individual may require hearing aids.

Hearing aids, do not replace your hearing, but amplify the sound. New digital hearing aids can be tailored to an individual's unique hearing loss. Digital aids are also able to remove distortion that was present in the older analog hearing aids and reduce feedback. The modern aids are also tailored to pick up speech frequencies and help hear speech when there is background noise.

Both children and adults can wear hearing aids. With very early detection of hearing impairment, young babies are now being fitted with aids to make sure that they do not miss out on the crucial aspects of development with respect to speech and language.

Hearing aids work well for individuals with a mild to moderate loss. Hearing aids will help those with a profound loss, but to a lesser extent. For those with hearing loss in both ears it is advantageous to wear an aid in each ear not only to improve your hearing ability, but also to avoid auditory deprivation of the unaided ear.



Hearing aids used to be large and unattractive, but many modern ones are now so small that they are hardly noticeable.

Cochlear implants

Individuals with profound hearing loss may not benefit from ordinary hearing aids, but can often improve their hearing with a cochlear implant. Although the implant does not replace normal hearing it gives the listener a good representation of environmental sounds and is especially good for distinguishing speech sounds and spoken language. Normal hearing aids amplify the sound, implants attempt to bypass the damaged parts of the hearing mechanism and take the sounds straight to the auditory nerve. Implants require a surgical procedure to implant an electrode into the cochlea.

For more information on hearing impairment, hearing aids, cochlear implants, and activities to promote speech and language see www.icommunicatetherapy.com.



Tips to help with communication

There are many things we, and those around us, can do to make life easier when hearing impairment occurs:

- Explain to those around you that you have difficulties with hearing. This will allow others to compensate for, and understand your difficulties
- Avoid important discussions when you are in an environment with lots of environmental background noise, or background noise at home (e.g. the washing machine or the TV is on)
- Look at the person when you talk to them, often facial expressions and lip movement can give you lots of cues to tune into certain words
- If you are talking to someone with hearing impairment, speak clearly (but not exaggerated) and use your hands to gesture and add cues for the hearing impaired person
- Look after your hearing aid. It is a complex piece of equipment and needs care and maintenance
- When you first start using a hearing aid, you may find it a strange sensation and it may take a while to get used to it. Persist with wearing the aid because you will get used to it and see the benefits
- Investigate local support groups to find out about hearing impairment and the support services available
- Investigate what other equipment is available to help with hearing impairment such as vibrating alarm clocks, enhanced doorbells, services to help with the telephone calls etc

For more information on equipment to facilitate hearing and informative website links see www.icommunicatetherapy.com



To learn more about hearing impairment, hearing aids and strategies to enhance communication, you can read about and purchase books on our website www.icommunicatetherapy.com. Click this link to see our online Resource Centre.

Suggested Reading

Suggested reading:

Hearing Rehabilitation for Deafened Adults: A Psychosocial Approach by Anthony Hogan

Hearing Impairment, Auditory Perception and Language Disability by John Bamford and Elaine Saunders

Children With Hearing Loss: A Family Guide by David Luterman

Auditory-Verbal Therapy for Parents and Professionals by Warren Estabrooks

Inside Deaf Culture by Carol A. Padden and Tom L. Humphries

Advances in the Spoken-Language Development of Deaf and Hard-of-Hearing Children (Perspectives on Deafness) by Patricia Elizabeth Spencer and Marc Marschark

Infection and Hearing Impairment by Valerie E. Newton and Pamela J. Vallely

Hearing Differently: The Impact of Hearing Impairment on Family life by Morgan-Jones

Education of Children With Hearing Impairment by Suni Mathew

Living Well with Hearing Loss: A Guide for the Hearing-Impaired and Their Families by Debbie Huning

Your Child's Hearing Loss: What Parents Need to Know by Debby Waldman and Jackson Roush

Communication Skills in Hearing-Impaired Children by John Bench

Supporting the Hearing Impaired Infant by Penso

Deaf Culture: A to Z by Walter Paul Kelley and Tony Landon McGregor

Deaf Daughter, Hearing Father by Richard Medugno

Helping Deaf and Hard of Hearing Students to Use Spoken Language: A Guide for Educators and Families by Susan Easterbrooks and Ellen L. Estes